

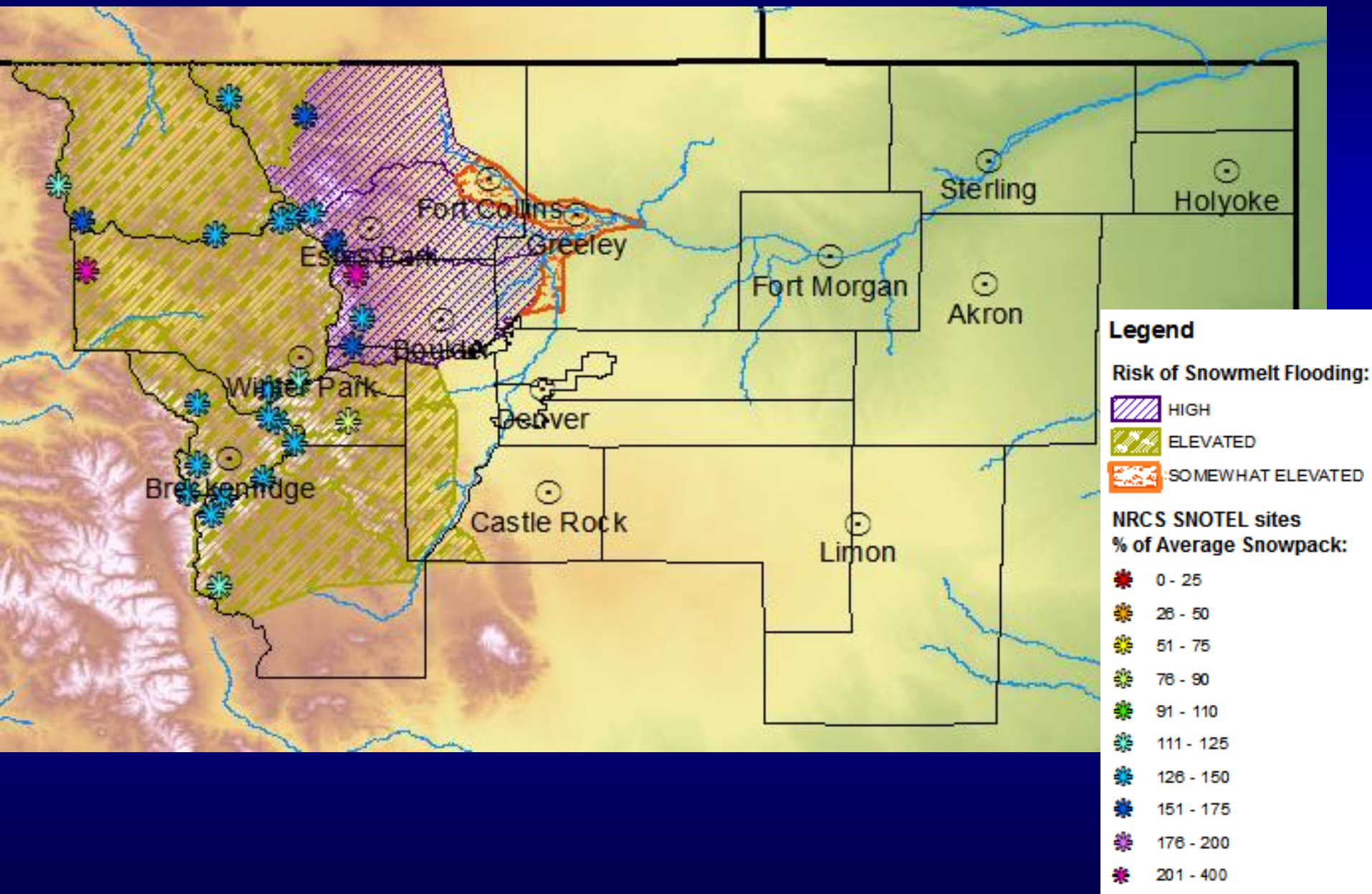
Spring Snowmelt Flood Potential Outlook

North Central & Northeast Colorado

- The potential for flooding remains high in Saint Vrain (including Boulder) Creek, Big Thompson River and the upper Cache La Poudre River drainages due to the September 2013 flood combined with much above average mountain snowpack in these basins.
- The risk of spring snowmelt flooding is elevated elsewhere in the north central mountains and northern Colorado Front Range due to the above average snowpack.
- The flood risk is somewhat elevated in southwest Weld County, and also along lower Cache La Poudre River in eastern Larimer and western Weld Counties due to flooding last September.
- There is a near normal spring flood risk elsewhere on the northeast plains, and the urban corridor from Broomfield County southward.

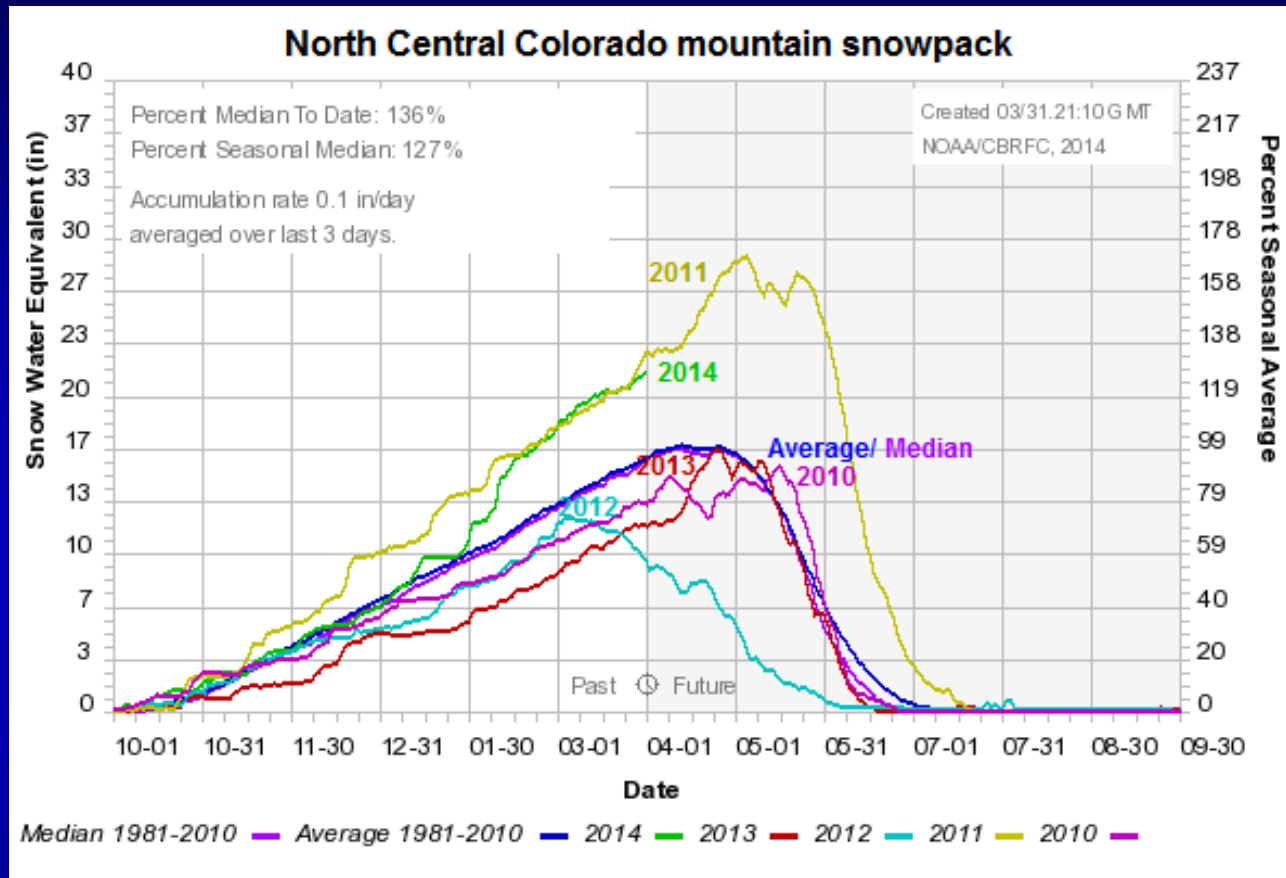
Spring Snowmelt Flood Potential Outlook Graphic

March 31st, 2014



Mountain Snowpack Timeseries Graph through March 31st, 2014

(each line is one of the past 5 years)



The snowpack is above average. The highest snowpack compared to average was in the high elevations of the St. Vrain, Big Thompson and North Platte River Basins east of the Continental Divide and the Blue River Basin west of the Divide.

* SNOTEL data for this graph provided by the NRCS.

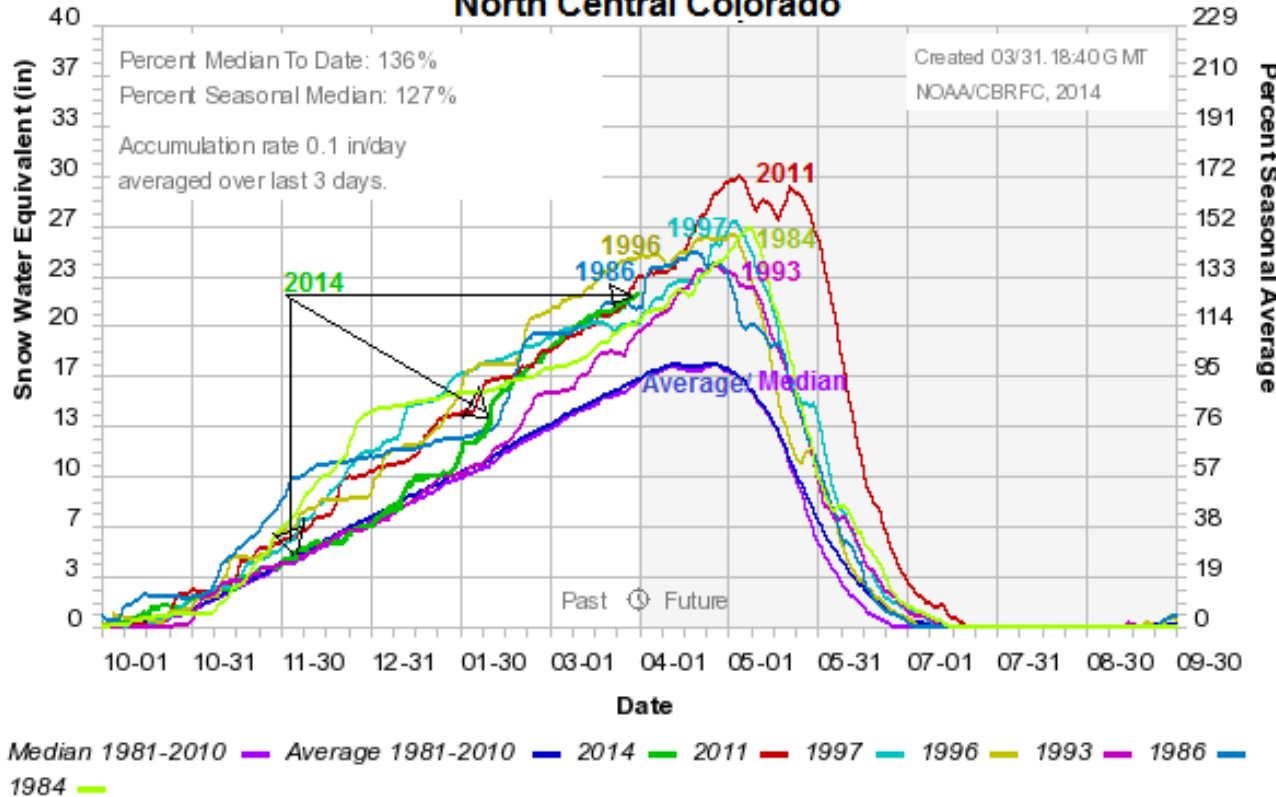
Additional time series graphs can be produced on the Colorado Basin RFC website at: <http://www.cbrfc.noaa.gov/station/sweplot/snowgroup.php>

NRCS Time Series Snowpack Graphs are available at:
<http://www.nrcs.usda.gov/.../detail/co/snow/products/...> (past 3 years) and
<http://www.nrcs.usda.gov/.../detail/co/snow/products/...> (high/low snowpack years). p

Mountain Snowpack Timeseries Graph

(7 of the highest % of average snowpack years)

Colorado Basin River Forecast Center North Central Colorado



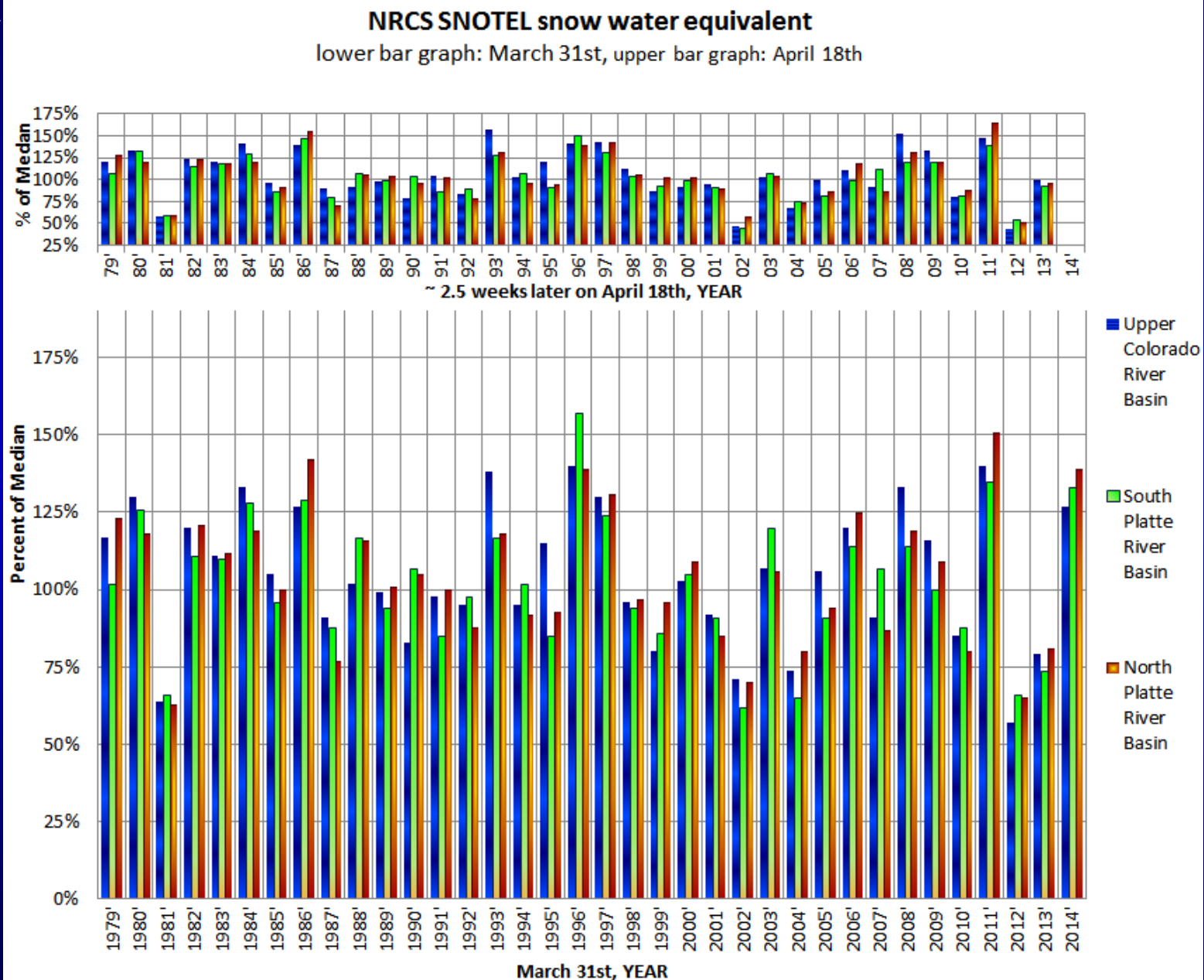
The high country snowpack at the end of March continued running neck and neck with the snowpack of 1986, 1997 and 2011; remaining a bit below the 1996 snowpack.

The current high country snowpack is roughly ~ 127% of the typical seasonal peak. Around 5% to 10% of the snow accumulation season remains.

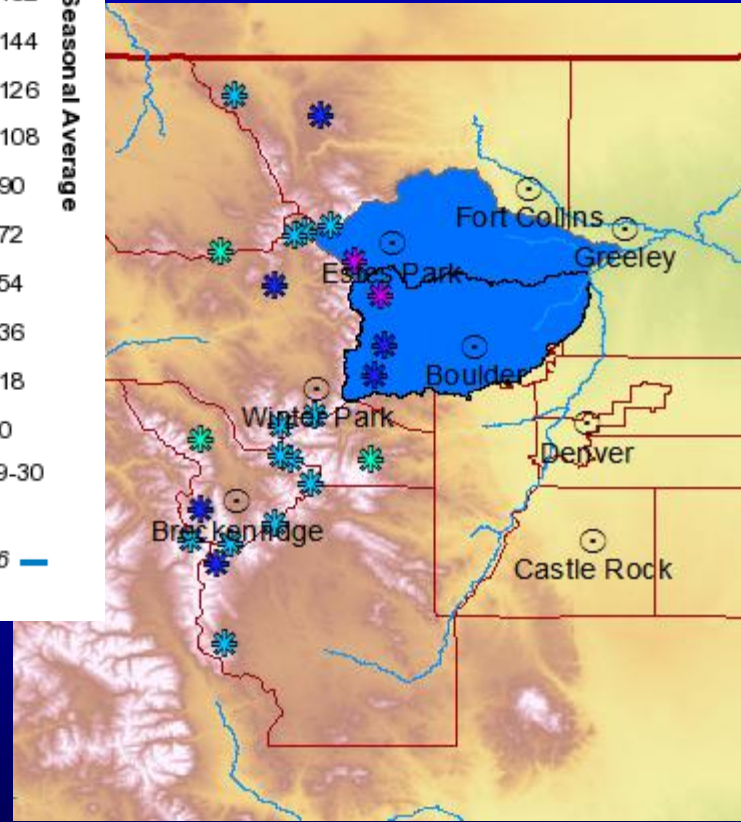
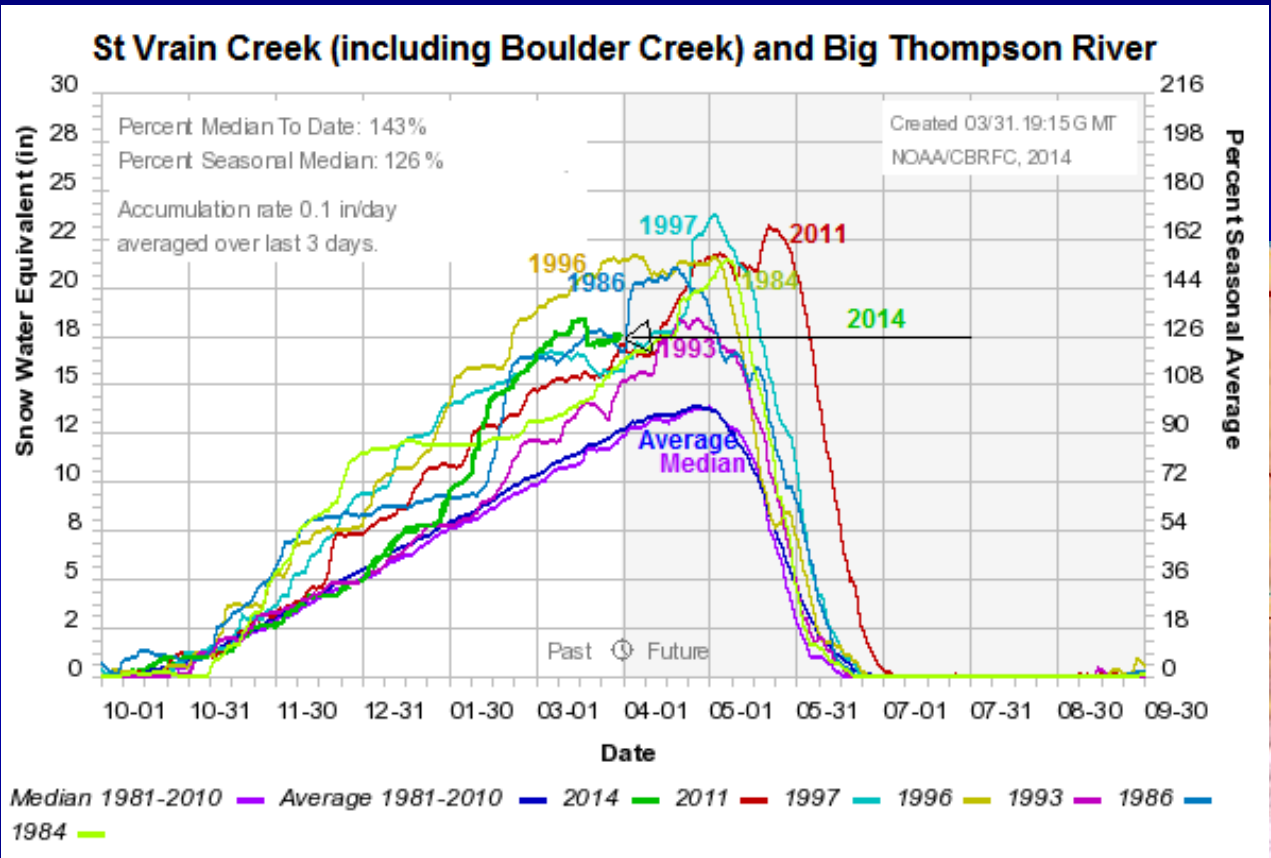
* SNOTEL data for this graph provided by the NRCS.

The March 31st, 2014 the mountain snowpack was the 3rd highest South Platte River Basin % of average end of March snowpack in the past 35 years. March 31st snowpack was higher in 1996 & 2011.

In the North Platte River Basin the 3/31/14' % of average snowpack was tied with 1996 as the 3rd highest percent of average snowpack (behind 2011, and 1986).



- The green line on the time series graph shows the NRCS SNOTEL SWE (snow water equivalent in the snowpack) from October 2013 through March 2014 in the Big Thompson and St. Vrain Creek Drainages. The blue/violet lines show the 1981-2010 average/median. The years displayed are some of the highest snowpack years.



The September 2013 flood was a hydrologic event (stream flooding), a geologic event (sedimentation & landslides), and a hydrogeologic event (high water table).

Many of the antecedent conditions for another flood remain:

Due to last September's rain and flooding; the risk of flooding and flash flooding is higher this year primarily in the Front Range Foothills extending into the urban corridor in Boulder, Larimer, SW Weld and extreme Nrn Jefferson Counties.

- A small amount of water could start moving large quantities of sediment in affected streams.**
- There are reduced creek and river capacities due to the increased sedimentation, rocky debris and stream bank erosion.**
- Debris flows and landslides may cause access issues and obstruct creek flows.**
- Woody debris along streams could potentially cause debris dams and subsequent flooding.**
- Altered locations and conditions of streams may impact structures and infrastructures at risk.**
- Some reservoirs in these areas are at or near capacity and will spill earlier than usual causing additional flow during the runoff and thunderstorm season.**

These 6 risks are from the Boulder Office of Emergency Management: Post-Flood Community Preparedness Guide - Flash Flood, Landslide and Debris Flow 2014 Edition at: <http://www.bouldercounty.org/doc/flood/preparednessguide2014.pdf>

Other Issues:

High groundwater:

- There are numerous reports of high groundwater in areas severely impacted by the September 2013 rains. If groundwater is high and soils are saturated; there will be more snowmelt runoff and higher streamflows.

Landslides:

- The September 2013 rains destabilized hillsides and steep slopes . High groundwater can be a trigger for deep cut landslides. Increased landslides and rock slides will be possible this spring. However, landslides will also depend on other factors like heavy and/or prolonged rainfall, and how saturated the soils are this spring and summer.

Before a flood:

- Create a Communications Plan - It is important to be able to communicate with your family and friends in the event of a disaster. Whether it is having a specific person identified to contact for status updates or a safe location to meet up with family members, having a plan in place will give you peace of mind if disaster does strike.
- Prepare your Family & Pets – Planning can help you and your family evacuate faster. Also, have a plan for your pets so you won't be delayed in the danger zone. Don't wait until the last moment to gather the essentials for yourself, your family and/or your pets.
- Plan to Go to a Safe Location – Identify locations located at higher ground in case of flooding. Know more than one way to get to your safe locations on foot if necessary.
- Assemble an Emergency Kit - It is good practice to have enough food, water and medicine on hand at all times to last you at least 3 days in the case of an emergency. Water service may be interrupted or unsafe to drink and food requiring little cooking and no refrigeration may be needed if electric power is interrupted. You should also have batteries, blankets, flashlights, first aid kit, rubber boots, rubber gloves, and a NOAA Weather Radio or other battery operated radio easily available.
- Prepare Your Home - If you have access to sandbags or other materials, you may be able to use them to protect your home from flood waters if you have sufficient time to do so. Filling sandbags can take more time than you may think.

Nolan Doesken, Colorado State Climatologist, explained:

- * • Spring months (March – early June) can swing dry or wet very, very quickly.**
- There are several months of spring flood potential to come.**
- This time of year is referred to as “showtime” because ‘Many possibilities lie ahead...’**

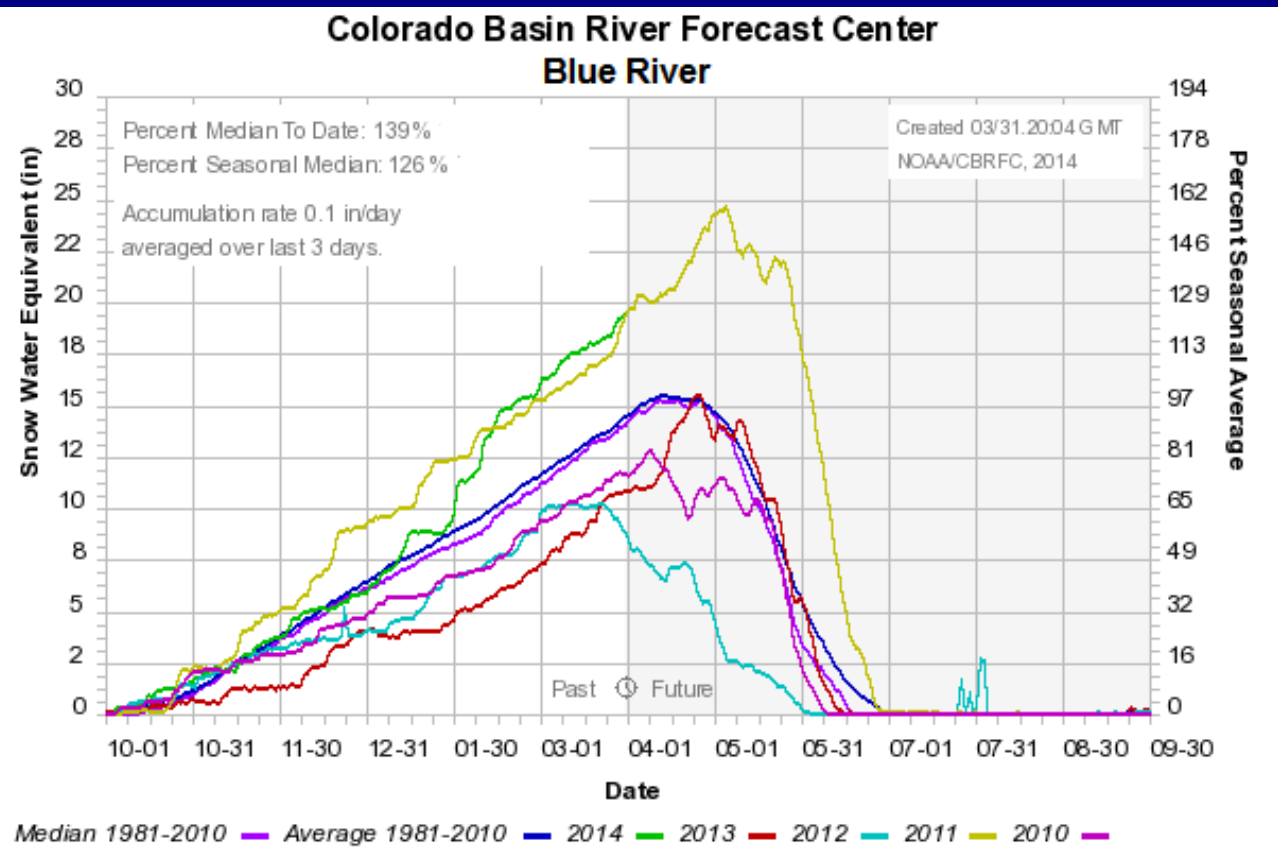
*** from Nolan’s presentation at the Colorado Water Conservation Board (CWCB) Flood & Water Availability Task Force Meeting on March 20th. Nolan’s presentation includes a slide on types of Colorado floods and if they are common, rare, etc. This Colorado Climate Center update and other presentations are available on the CWCB website at: <http://cwcb.state.co.us/public-information/flood-water-availability-task-forces/Pages/main.aspx>**

The Colorado Climate Center’s website is at: <http://climate.atmos.colostate.edu/>

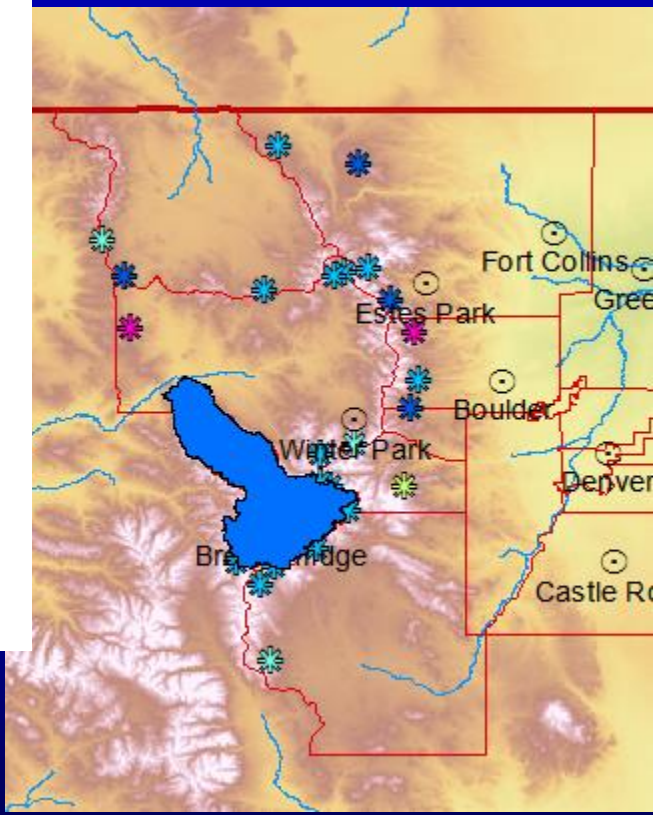
Some Factors than may impact the mountain snowmelt:

- **Future snowfall**
- **Stream levels during the melt**
- **When and how fast the snow melts (freezing and thawing in the mountains)**
- **Future rainfall amounts and timing**
- **Whether rain (especially a warm rain) falls on the snowpack**
- **Groundwater/soil moisture**
- **Dry winds**

The next 7 slides show graphs the mountain snowpack time series for the past 5 years in areas of north central Colorado (graphs east of the Divide may not include data for all NRCS SNOTEL sites).

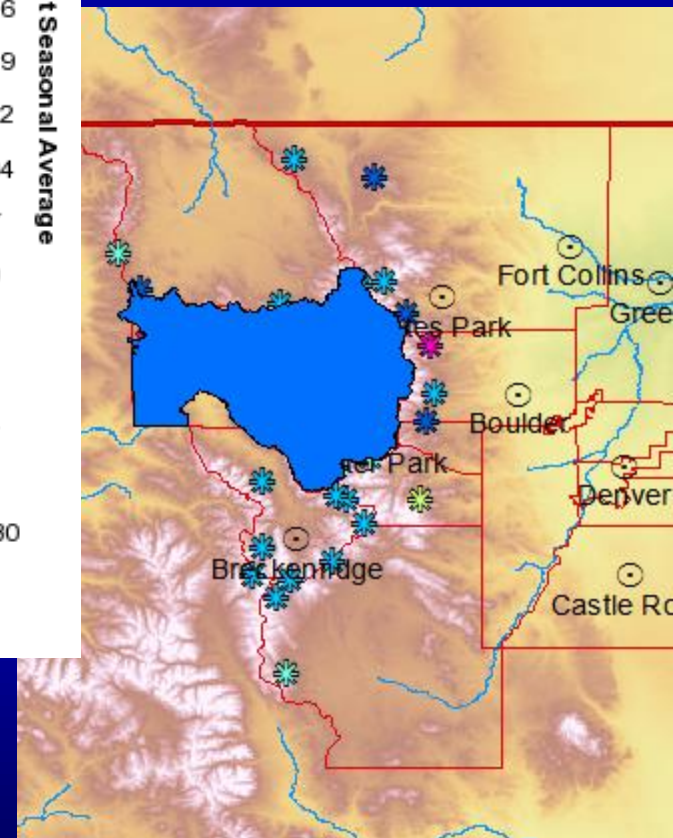
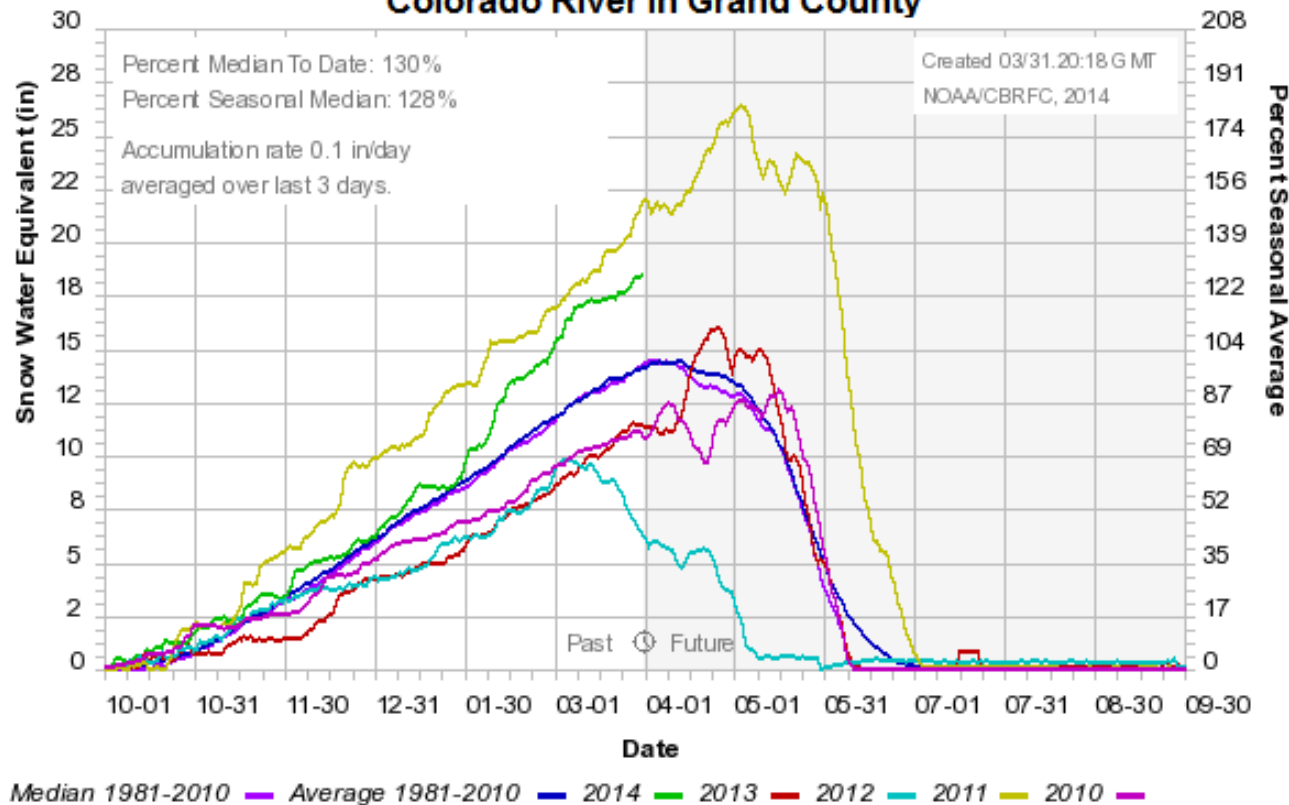


The Blue River Basin snowpack continues to steadily increase.

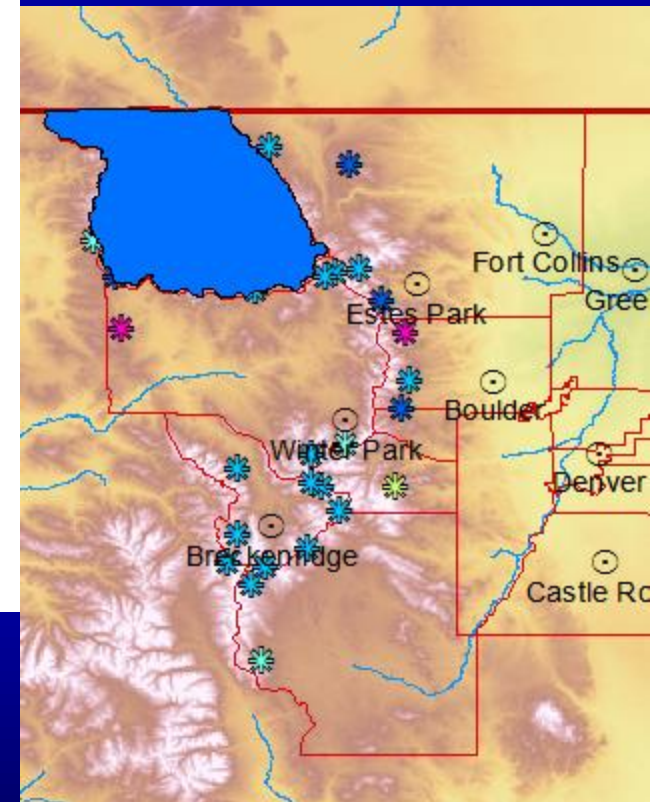
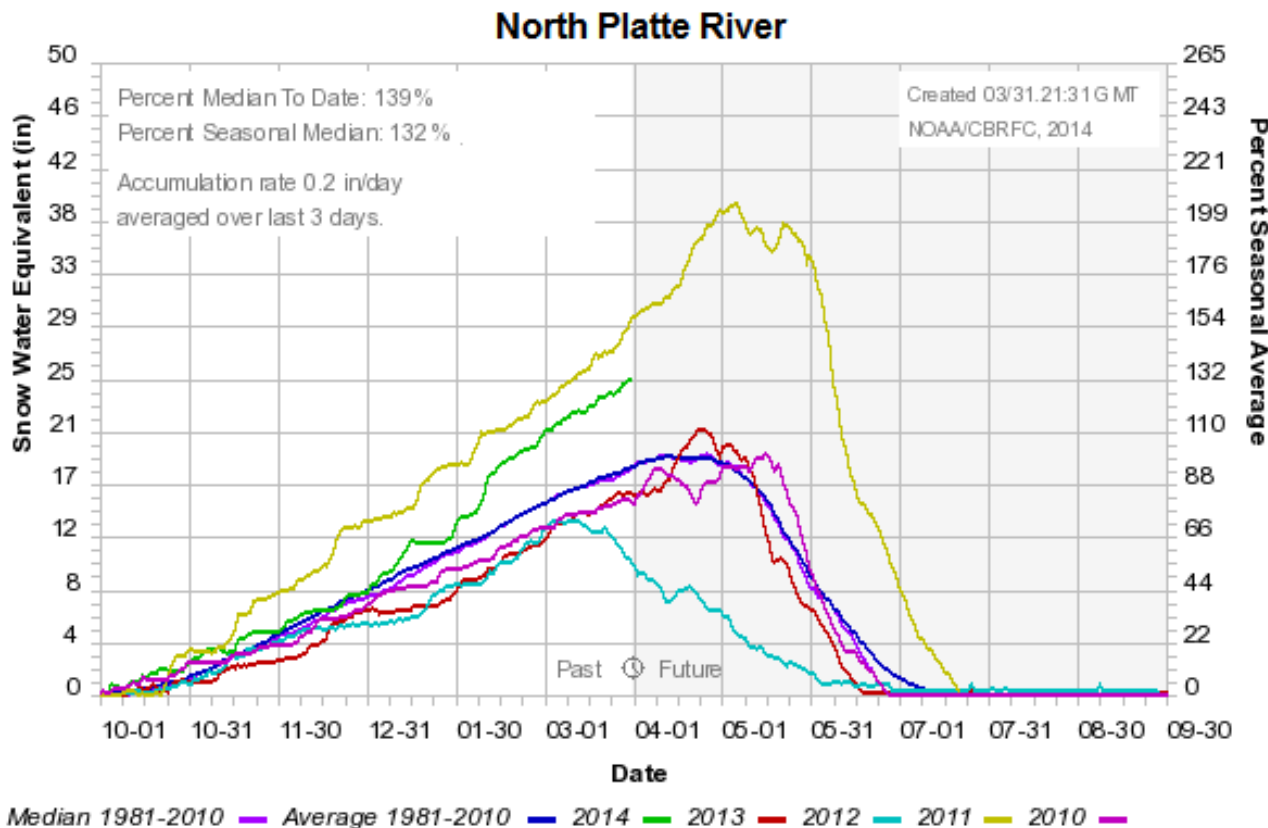


The 2014 water year (October 2013 through March 31st, 2014) is the green line on the next 5 graphs.

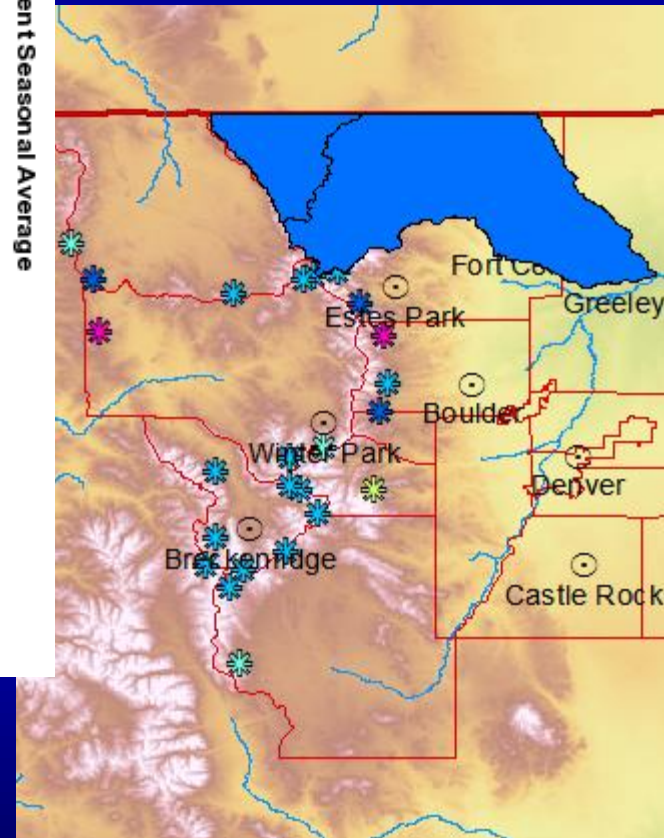
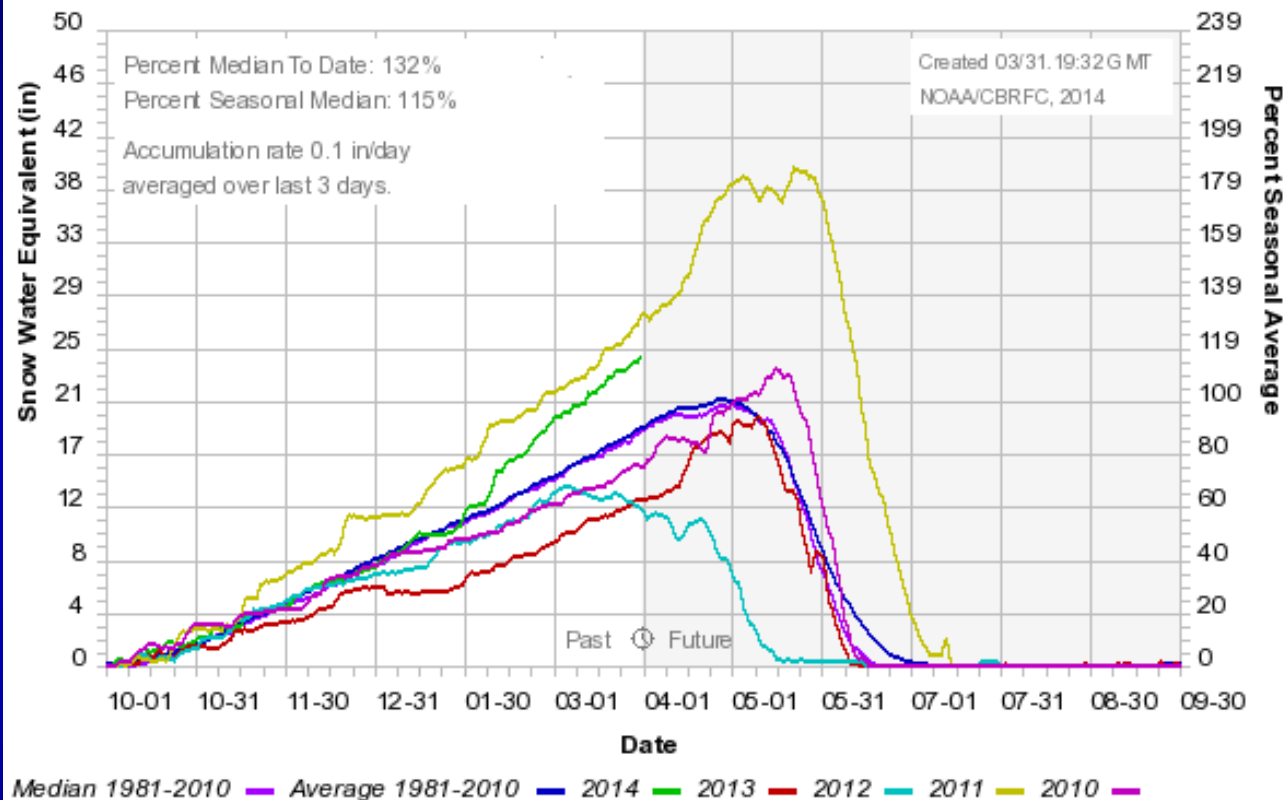
Colorado Basin River Forecast Center Colorado River in Grand County



The North Platte River Basin snowpack continues to steadily increase.

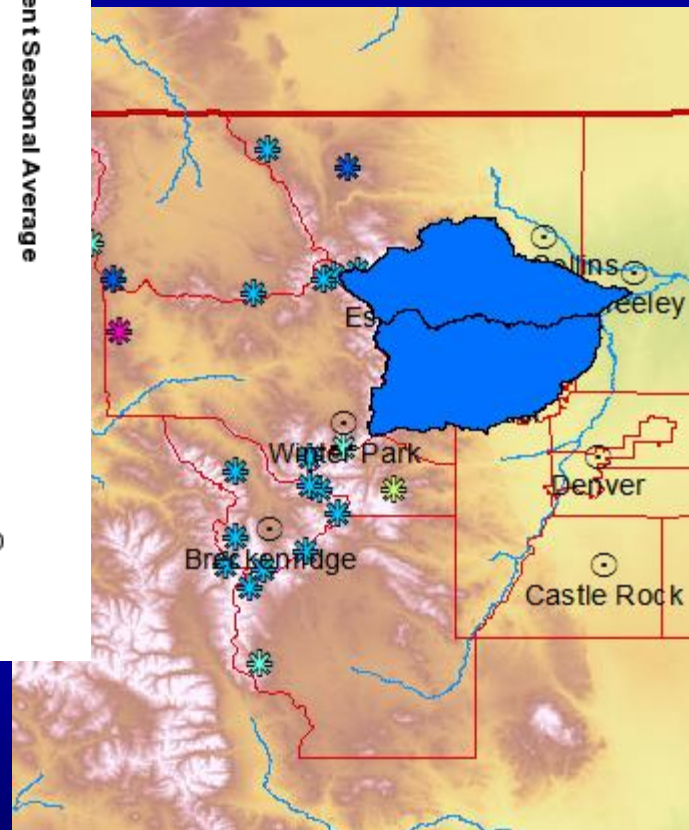
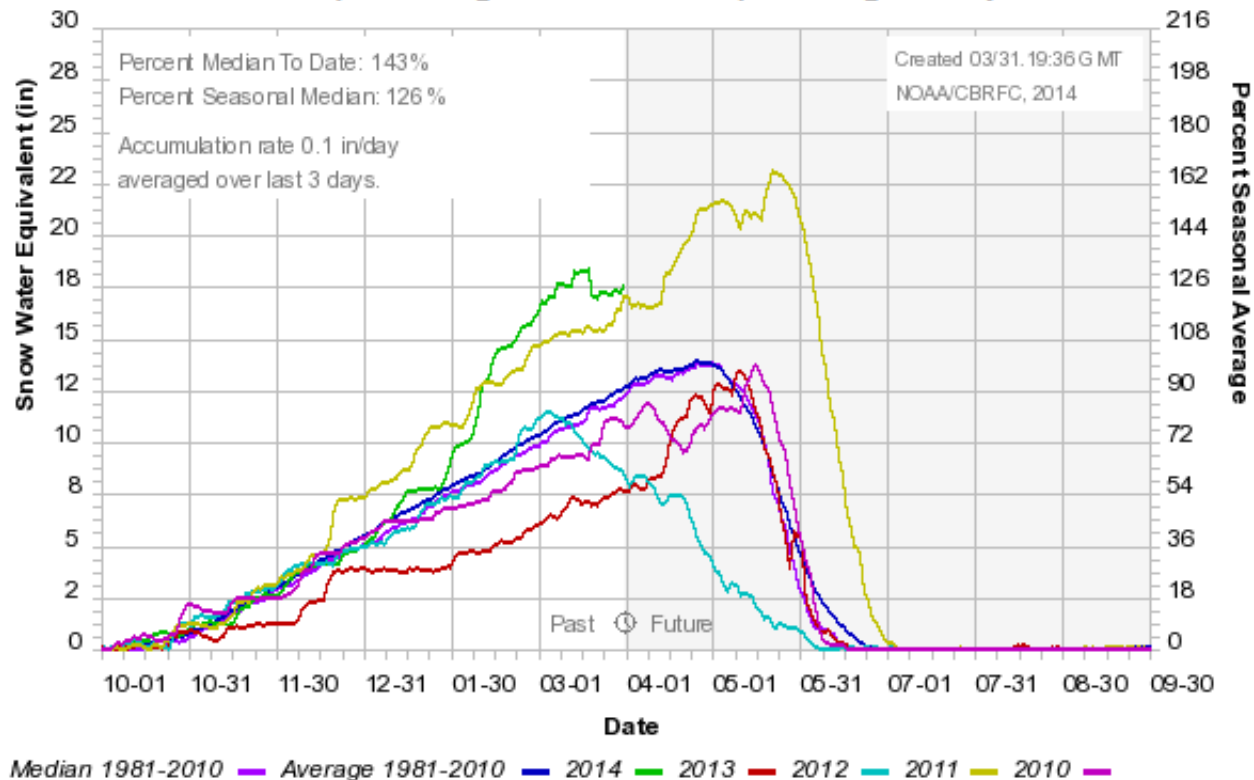


Cache La Poudre & Laramie Rivers

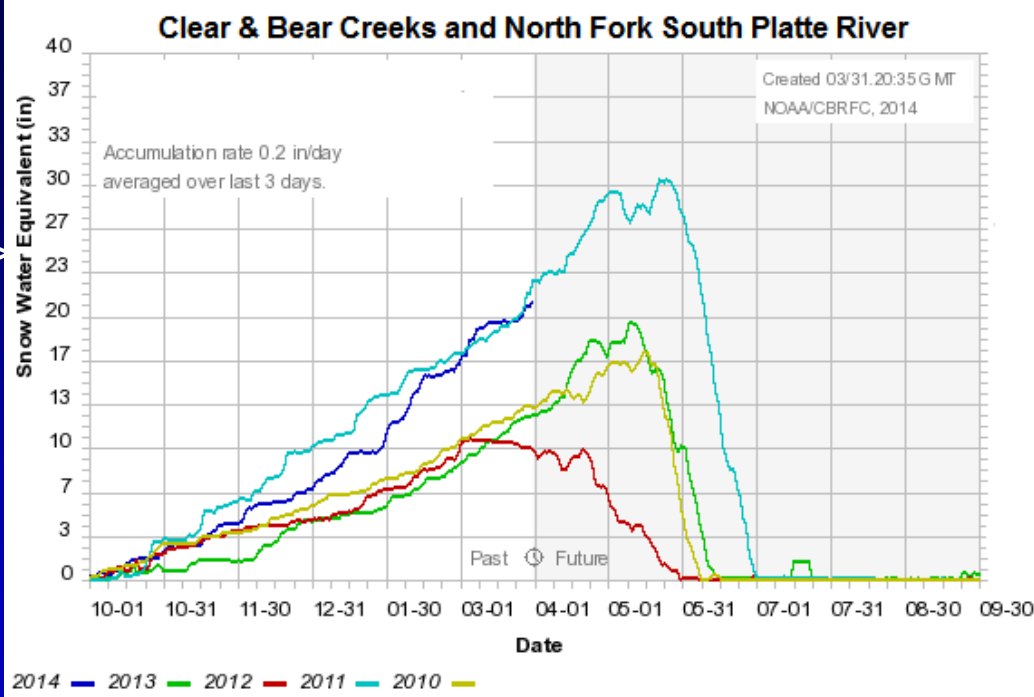


- Although remaining high, the mountain snowpack in the St Vrain (including Boulder) Creek and Big Thompson River drainages has leveled off the past week and a half.

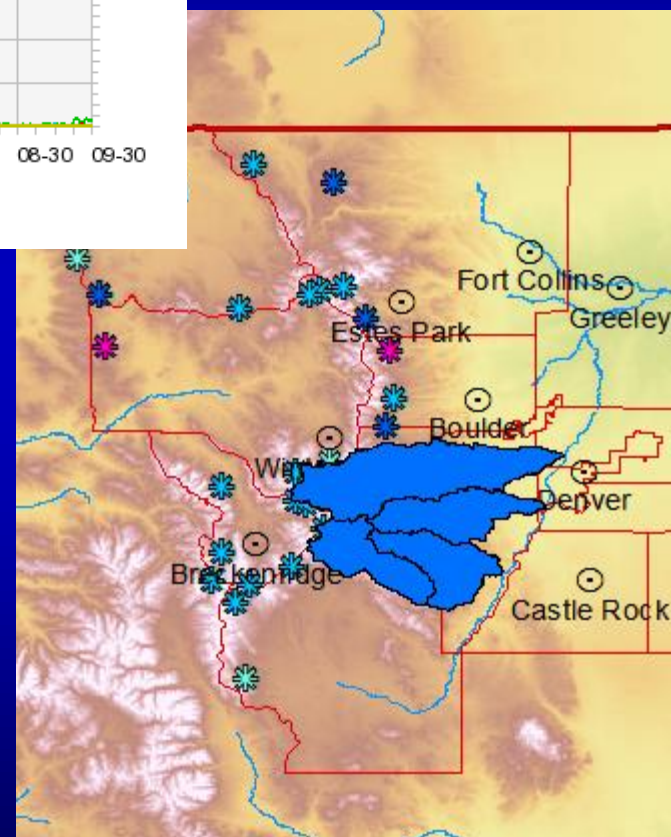
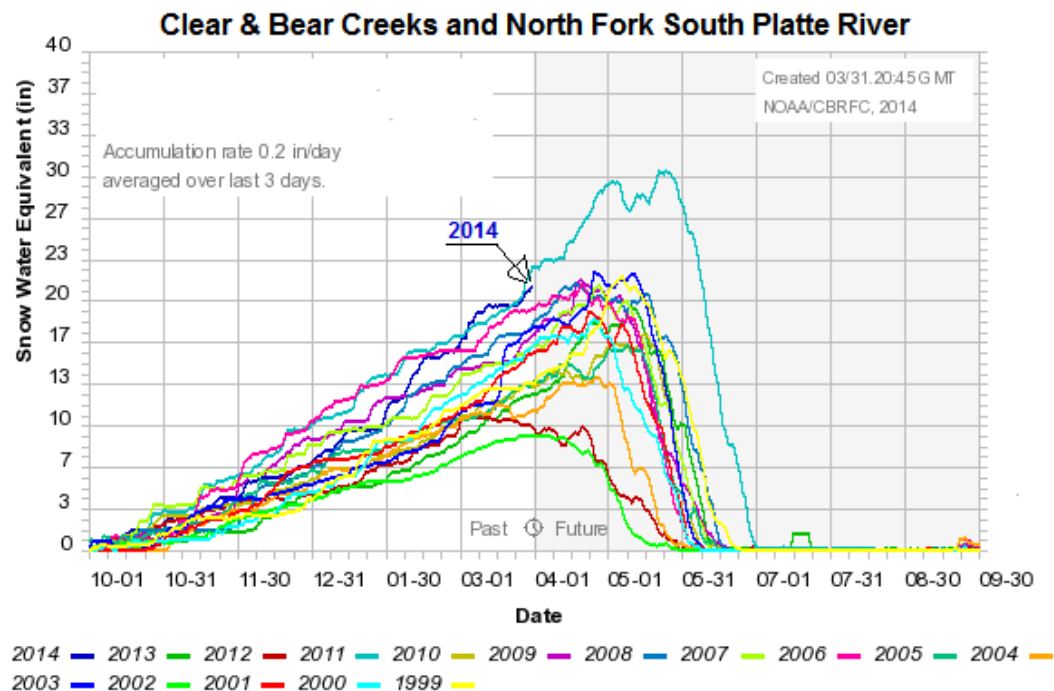
St Vrain Creek (including Boulder Creek) and Big Thompson River



Past 5 years =>

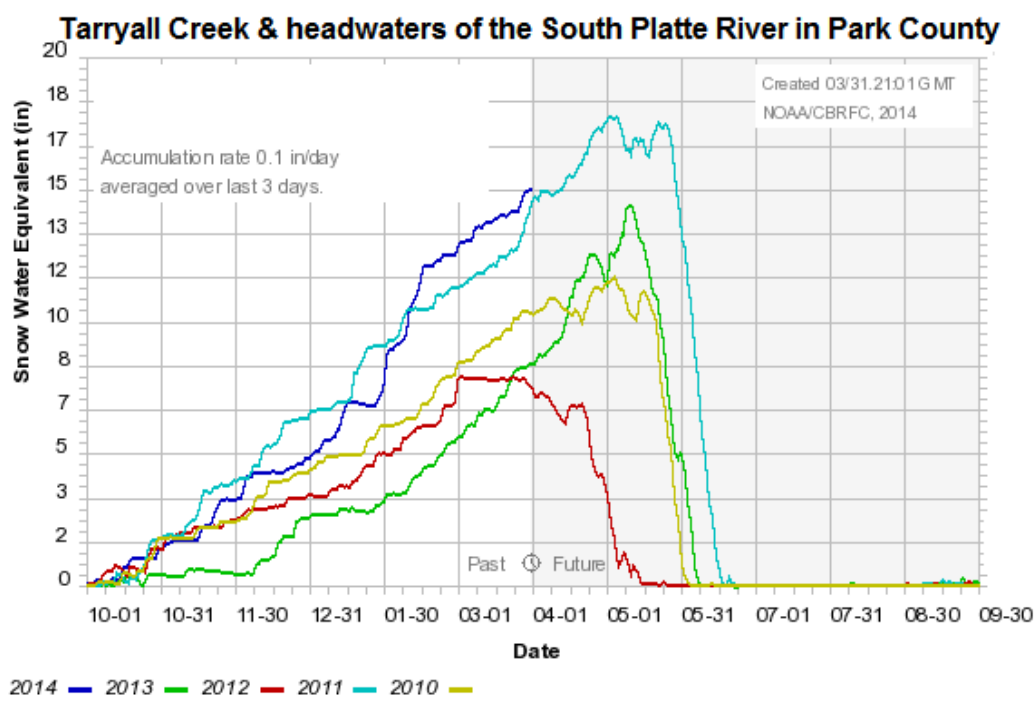


Average/median data was not available for these time series graphs.

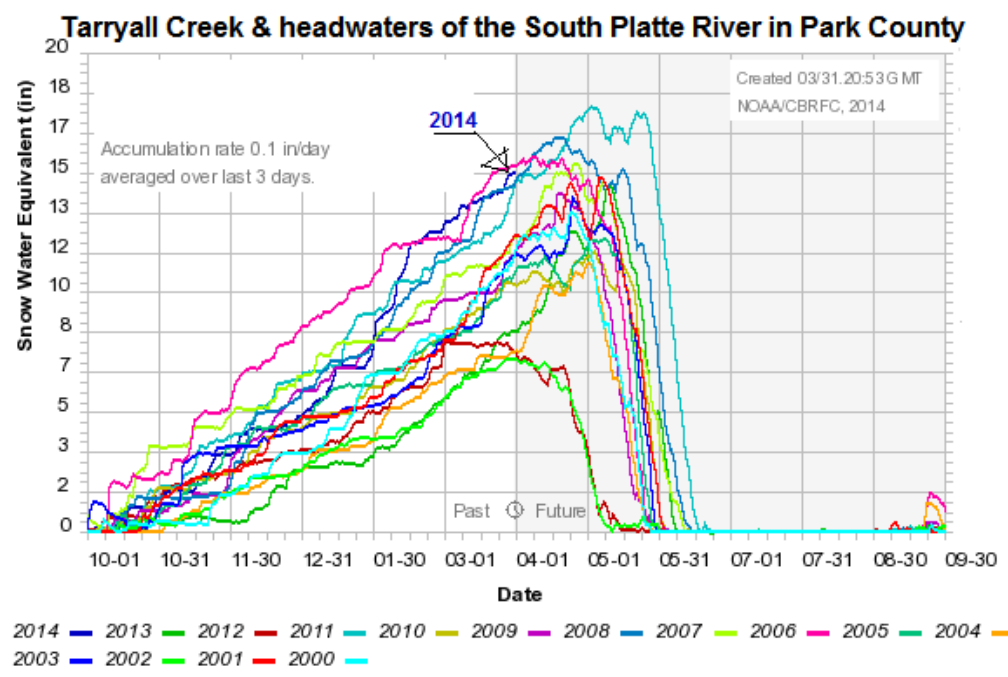


← Past 16 years

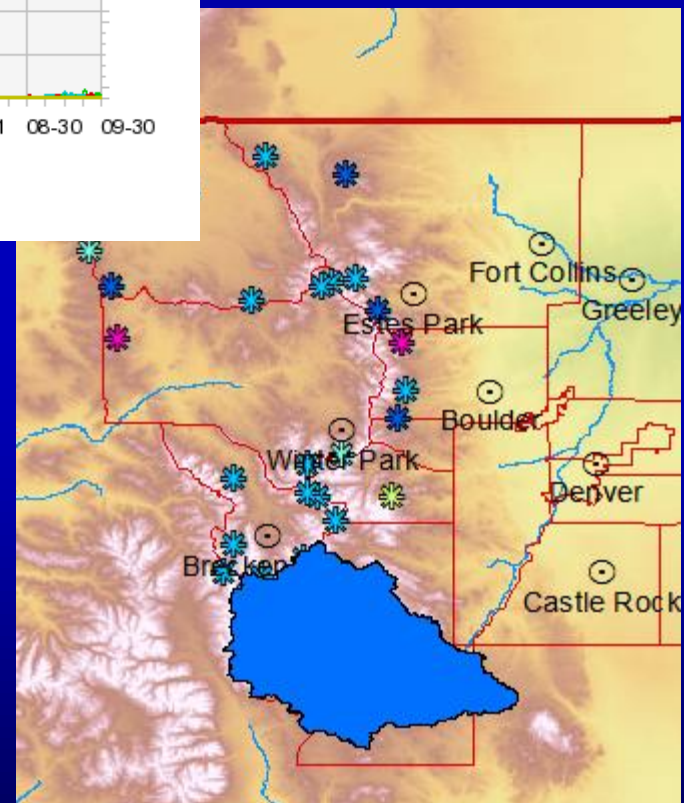
Past 5 years =>



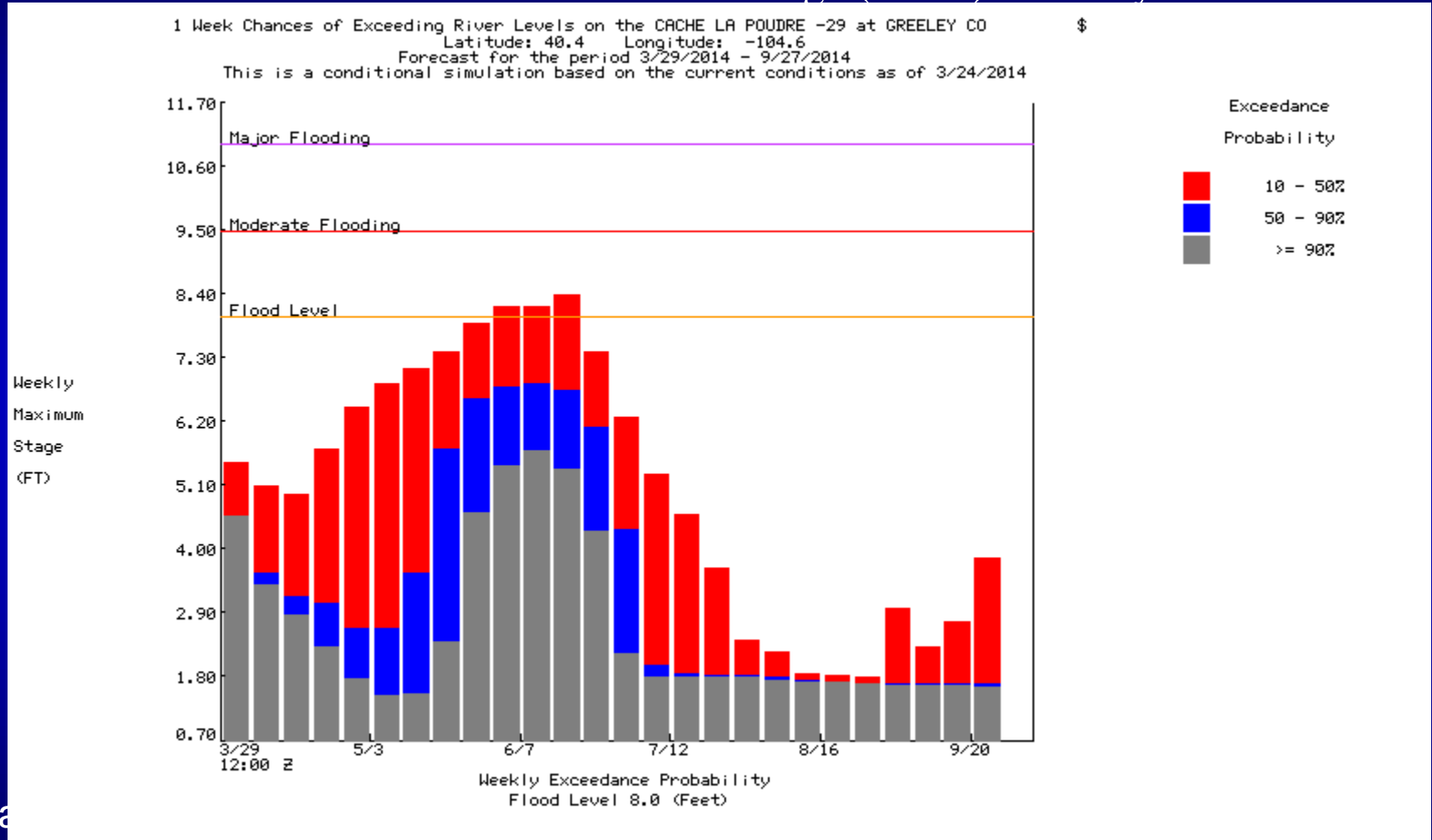
Average/median data was not available for these time series graphs.



←Past 15 years



The NWS AHPS graph below gives the probability that the maximum stage on the Cache La Poudre River near Greeley will exceed a particular value each week from late March through September 2014. There is a 10% to 50% chance the Cache La Poudre River at this location will rise near flood stage (8 feet) late May-mid June 2014.



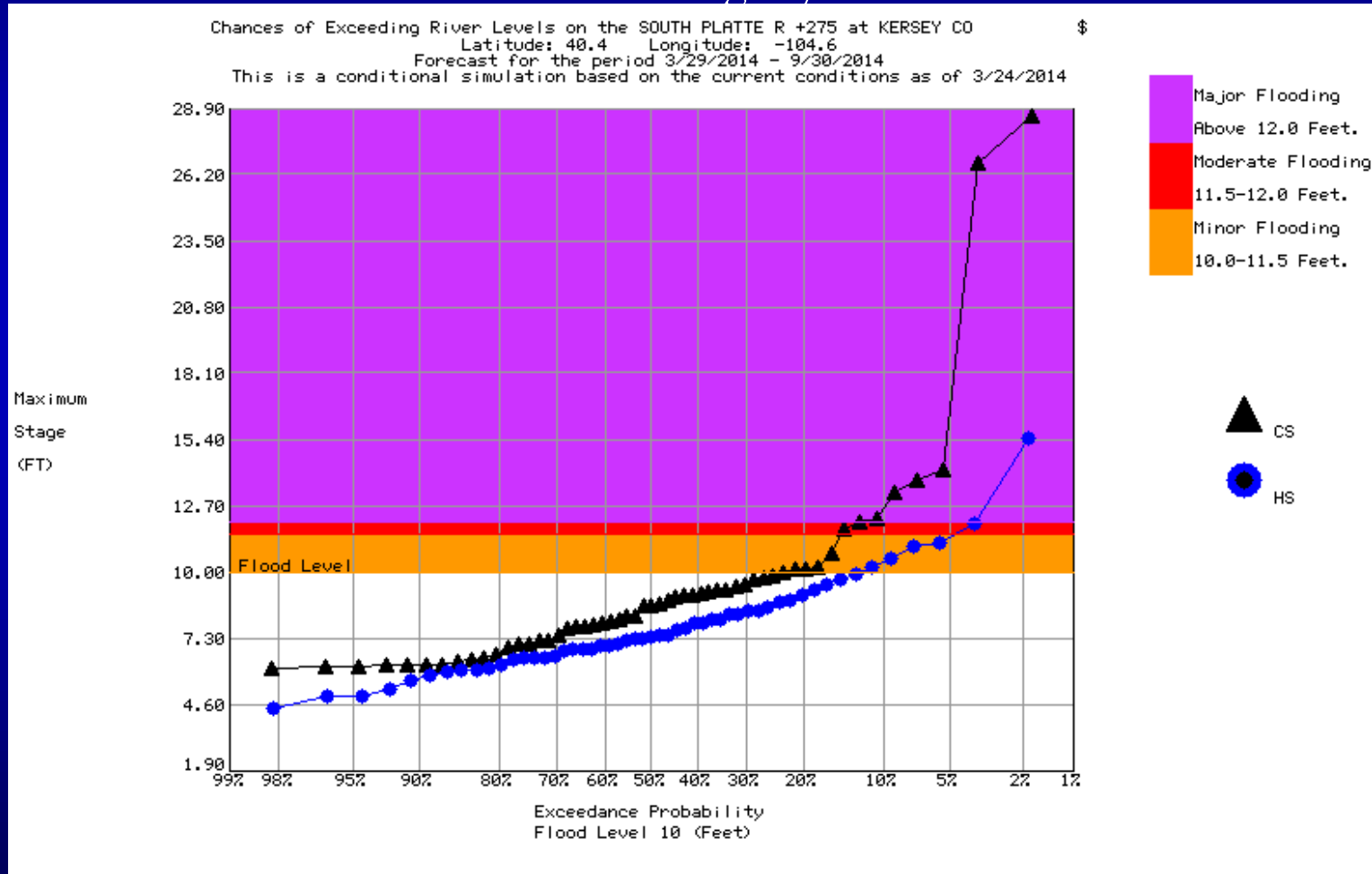
Gr

<http://water.weather.gov/ahps2/>. The probabilistic forecast points are marked by circles on the AHPS map. The probabilistic outlook graphics are accessible by clicking the tabs above the forecast point's hydrograph.

This AHPS probabilistic graph gives the chances of the stage going above various levels due to a normal runoff this year (April through September). The graph shows the South Platte River at Kersey has a 23% chance of reaching flood stage (of 10 feet) this year. In an 'average' year, the South Platte River at Kersey has a 12% chance of reaching flood stage. It has a 10% chance of moderate flooding this year, compared with a 5% chance in an 'average' year.

The conditional simulation (CS) line indicates chances of the river going above given levels based on current conditions.

The historical simulation (HS) line indicates the chances of the river going above given levels based on the total range of past levels.



The Kersey forecast point is just downstream of the confluence of the Cache La Poudre and South Platte Rivers in Weld County.